

AN INDUSTRIAL BREAKDOWN OF  
NASA EXPENDITURES

Lloyd D. Orr  
David Jones  
Indiana University  
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## I. Introduction

This paper is an outgrowth of a study designed to assess the feasibility of an input-output analysis showing NASA's impact on the U.S. economy. It was proposed that production coefficients derived from a modified national input-output table should be used in connection with final demand vectors of expenditures constructed from NASA's own internal data. Such an analysis would show the total resource use and industrial structure required to support the space program over a given period of time.

A final demand vector for NASA is a column of figures showing an industrial breakdown of direct expenditures by NASA for the goods and services needed to support the space program. The feasibility study naturally led to careful examination of the data available from NASA that could be used to establish an industrial classification of NASA expenditures. On the basis of these data it has been possible to construct final demand vectors for the fiscal years 1966 and 1967. The industrial breakdown is by the four digit standard industrial classification (SIC) establishment codes compiled by the Bureau of the Budget. Partial data were obtained for other fiscal years but were not sufficient for the construction of additional final demand vectors.

Work currently being undertaken by NASA in the assignment of SIC codes to expenditure data should make the construction of additional final demand vectors possible. Since this SIC code assignment project involves subcontract as well as prime contract data, it may also provide the information required to modify national input-output tables so that they can be used with reasonable accuracy for an input-output analysis of NASA's procurement and expenditure program. An I-O analysis would establish indirect as well as direct expenditure effects. For the present we must be content with an industry breakdown of direct expenditures.

## II. Data and Procedures

The focus of our attention for a final demand vector is a prime contract or other direct expenditure made by NASA during a particular fiscal year. The appropriate concept of expenditures is close to the accounting concept of accrued costs, although there are some minor differences that we will note. What we need for the final demand vector is an industrial breakdown of the dollar value representing direct resource use resulting from NASA's activity during a particular period of time. This concept of resource use should be distinguished conceptually from the incurring or removing of an obligation, although under some circumstances the accounting concept of obligations is very close to resource use in a statistical sense. In some cases obligations are used as the most accurate representation of accruals (resource use) available to us.

Table I presents a highly aggregated breakdown of the expenditure categories to be covered by the final demand vectors. Although there will be some regrouping for consistency with the sample data available to us, these figures represent the basic control totals that will condition the use of sample data in estimating a detailed industrial breakdown. Where samples are used, sample proportions of expenditures in each industry are regarded as point estimates of actual proportions. Details of this process and of other procedures used are contained in the appendix.

The essential task is to disaggregate the figures shown in Table I according to expenditures made in each industry. Several sources of data were used for this purpose.

EIS: NASA's Contractors' Economic Information System was the primary source of data used in this study. These data are collected in cooperation with the Department of Defense from government contractors (DOD and NASA

TABLE I  
NASA Expenditures: Accrued Cost by  
Fund Source Categories  
(\$000)

Expenditure Category	FY 1966	FY 1967
A. Administrative Operations	\$ <u>606,086</u>	\$ <u>645,704</u>
1. Fund Source 1 Wages and Supplements	379,706	410,113
2. Fund Source 2 Travel	17,702	17,920
3. Fund Source 3 Miscellaneous A.O.	208,678	217,671
B. Research and Development		
1. Fund Source 4	\$ <u>4,851,293</u>	\$ <u>4,428,688</u>
C. Construction of Facilities	\$ <u>575,107</u>	\$ <u>249,742</u>
1. Fund Sources 5 & 7 Installation	566,231	245,970
2. Fund Sources 6 & 8 Design and Engineering	8,876	3,772
Total Accrued Cost	\$ <u><u>6,032,486</u></u>	\$ <u><u>5,324,134</u></u>

Source: NASA Financial Management and Resources Analysis Divisions

Plantwide Economic Report, Budget Bureau No. 22-R-261). The pertinent information furnished for our purpose is: 1) accrued costs for prime contracts and 2) SIC establishment codes for the plants where the work is located. There is a 75-80 percent coverage of all NASA contracts and virtually complete coverage of large ones. The data coverage is heavily concentrated in research and development contracts, including both hardware and technical services.

Construction of Facilities: The industrial breakdown of construction was obtained by sampling accrued costs on construction contracts for the two years covered by our final demand vectors. These data are available in a NASA data printout titled Status of Contracts and Grants, No. 12 (SCAG-12). Costs are accrued on contracts monthly during a fiscal year so that the June 30 printout will show accrued costs for the entire fiscal year. A ten percent random sample of contracts was taken and SIC codes were assigned on the basis of descriptions in the printout supplemented by cooperative assistance from knowledgeable NASA personnel.

Administrative Operations: Because administrative expenditures are usually of a current nature there is a very close relationship between obligations and the use of resources as compared with the long-term commitments and lags inherent in construction, or research and development programs. It was, therefore, feasible to use a detailed obligations printout as representative of accrued administrative costs. In fact, fund sources 1 and 2 as shown in Table I are actually the obligations for the two fiscal years shown. Fund source 3, which is the only category in which there can be a substantial difference between obligations and accruals, is the residual between total administrative operations accrued costs and the obligations figures shown for fund sources 1 and 2. The procedures used to assign SIC codes to the detailed

obligations data within each of the fund sources (1, 2 & 3) are described in the appendix.

### III. Final Demand Vectors Fiscal Years 1966 and 1967

From the three primary sources of data listed in the previous section, accrued cost accounting figures, and supplemental information provided primarily by NASA personnel, it has been possible to provide the industrial breakdown of NASA expenditures for the fiscal years 1966 and 1967 as shown in Table II. There is no basis in the procedure employed for providing interval estimates for figures in the industrial breakdown. Nevertheless, it is the judgment of the authors that the data used provided a greater degree of accuracy than is usually obtained in studies of this sort. This was, of course, at the expense of a considerable amount of time for the quantity of results produced. The interested reader is referred to the appendix for detail on the data and procedures used in moving from the control totals of Table I to the final demand vectors of Table II.

TABLE II  
Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)

SIC	Description	FY 1966	FY 1967
V.A.	Value Added (wages and wage supplements)	379,717	409,844
0731	Landscaping	0	51
1511	General Building Contractors	214,640	195,655
1511x		23,990	26,867
1611	Highway and Street Construction	81,656	615
1621	Heavy Construction n.e.c. <sup>1</sup>	29,115	5,212
1711	Plumbing, Heating and Air Conditioning	1,725	783
1731	Electrical Work	63	901
1761	Roofing and sheet Metal	288	0
1791	Structural Steel Erection	0	5,027
1794	Excavation and Foundations	0	1,676
1796	Installation of Building Equipment n.e.c. <sup>1</sup>	6	0
1799	Special Trade Contractors n.e.c. <sup>1</sup>	31,605	438
1925	Complete Guided Missiles System Assembly and Related Engineering	1,329,853	1,175,438
1929	Ammunition, except Small Arms	942	629
1941	Sighting and Control Equipment	3,620	862
1999	Ordnance and Accessories n.e.c. <sup>1</sup>	3,982	1,636
2542	Metal Partitions and Fixtures	0	219
2700	Printing and Publishing	2,853	3,635
2700x		2,230	2,013
2800	Chemicals and Allied Products	6,013	4,704
2800x		311	1,791
2813	Industrial Gases	89,868	50,967
2813x		11,801	30,755



Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)  
(continued)

SIC	Description	FY 1966	FY 1967
2818 2818x	Industrial Organic Chemicals n.e.c. <sup>1</sup>	173 24	104 62
2911	Petroleum Refining	1,727	1,042
3069	Fabricated Rubber Products n.e.c. <sup>1</sup>	2,444	42
3300 3300x	Primary Metals	3,176 119	2,867 196
3312	Blast Furnaces and Steel Works	684	801
3352	Aluminum Rolling and Drawing	0	337
3357	Nonferrous Wire	178	0
3423 3423x	Hand and Edge Tools n.e.c. <sup>1</sup>	1,272 43	520 41
3429 3429x	Hardware n.e.c. <sup>1</sup>	1,427 160	1,495 158
3443	Fabricated Plate Work	0	2,248
3449	Misc. Metal Work	1,415	0
3450 3450x	Screw Machine Products	1,427 160	1,495 158
3494 3494x	Valves and Pipe Fittings	9,707 267	8,493 318
3511	Steam Engines and Turbines	733	537
3535	Conveying Equipment	0	34
3537	Industrial Trucks and Tractors	63	0
3541 3541x	Machine Tools, Metal Cutting	2,543 87	1,041 82
3548	Metal Working Machines n.e.c. <sup>1</sup>	6	0

Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)  
(continued)

SIC	Description	FY 1966	FY 1967
3553	Woodworking Machinery	1,272	520
3553x		44	41
3559	Special Industry Machinery n.e.c. <sup>1</sup>	12	0
3561	Pumps and Compressors	644	0
3569	General Industry Machinery n.e.c.	13,369	0
3573	Electronic Computing Equipment	205,135	68,996
3573x		2,598	2
3574	Electric Accounting Machines	979	634
3574x		0	29
3611	Electric Measuring Instruments	1,508	669
3612	Transformers	246	212
3613	Switchgear and Switchboard Apparatus	2,755	16,781
3621	Motors and Generators	1,904	2,371
3622	Industrial Controls	0	17
3629	Electrical Industrial Apparatus n.e.c. <sup>1</sup>	0	126
3660	Communications Equipment	0	1,557
3660x		670	377
3661	Telephone and Telegraph Apparatus	473	1,238
3662	Radio and T.V. Equipment	316,239	358,929
3670	Electronic Components	0	0
3670x		2,010	1,133
3674	Semiconductors	21,358	187
3679	Electronic Components n.e.c. <sup>1</sup>	7,873	16,066
3691	Storage Batteries	0	783
3693	X-Ray Apparatus and Tubes	0	539

Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)  
(continued)

SIC	Description	FY 1966	FY 1967
3711 3711x	Motor Vehicles	5,586 178	2,442 88
3722	Aircraft Engines and Engine Parts	485,899	417,252
3721 & 3729	Aircraft, and Aircraft Equipment n.e.c. <sup>1</sup> Unbroken	1,442,467	1,358,645
3721x & 3729x		223	171
3721 & 3722 & 3729	Aircraft, Aircraft Engines, and Equipment n.e.c. <sup>1</sup> Unbroken	143,550	130,948
3731	Shipbuilding and Repair	985	439
3811 3811x	Engineering and Scientific Instruments	7,387 1,574	4,365 776
3821	Mechanical Measuring Devices	8,177	29,094
3822	Automatic Temperature Controls	137	441
3831	Optical Instruments and Lenses	1,710	269
3842	Surgical Appliances and Supplies	74	0
3861 3861x	Photo. Equipment and Supplies	9,418 328	12,009 401
3871	Watches and Clocks	101	45
4011 4011x	RR's, Line-Haul	1,032 84	1,105 22
4121	Taxi	174	186
4212 4212x	Local Trucking	1,270 107	1,542 1

Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)  
(continued)

SIC	Description	FY 1966	FY 1967
4213 4213x	Trucking, except Local	5,410 425	5,931 102
4224	Household Goods Warehousing	0	1
4266 4266x	Special Warehousing and Storage n.e.c. <sup>1</sup>	125 14	152 14
4400 4400x	Water Transportation	1,032 85	1,105 22
4511	Commercial Air Travel (certified)	7,318	7,544
4521 4521x	Noncertified Air Transportation	3,567 1,405	5,052 1,410
4582 4582x	Aircraft Servicing	2,605 835	7,061 1,232
4712 4712x	Freight Forwarding	2,745 433	3,127 0
4811 4811x	Telephone Communication	29,973 8,577	42,671 6,468
4931 4931x	Electric Services	7,706 4,840	8,262 6,016
4932 4932x	Gas Services	1,377 1,029	1,579 1,117
4941 4941x	Water Supply	257 291	351 239
4953 4953x	Refuse Systems	426 5	250 5
5812	Eating Places	3,286	3,388
6512 6512x	Nonresidential Building Operators	1,329 3,600	1,019 3,861
6531	Real Estate Agents, Brokers, etc.	0	269

Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)  
(continued)

SIC	Description	FY 1966	FY 1967
7011	Hotels and Motels	6,573	6,776
7211	Power Laundries	273	266
7332	Blueprinting and Photocopying	950	1,211
7332x		742	669
7339	Stenographic and Duplicating Services, n.e.c. <sup>1</sup>	526	366
7339x		466	149
7349	Misc. Custodial Service to Buildings	4,745	4,934
7349x		89	95
7391	R & D Laboratories	30,987	40,736
7392	Business Consulting Services	1,610	1,380
7392x		446	263
7393	Protective Services	4,532	5,955
7393x		236	1,287
7394	Equipment Rental and Leasing	3,366	3,730
7394x		475	13
7399	Business Services n.e.c. <sup>1</sup>	15,264	18,822
7399a	Computer Services	204,323	215,889
7399x		1,408	659
7399xb	Commission to other Govt. Agencies for C of F Management	28,062	2,231
7512	Car Rental and Leasing	468	338
7512x		1,604	1,168
7513	Truck Rental and Leasing	250	27
7513x		903	1,283
7523	Parking	57	62
7530	Automobile Repair	552	609
7530x		58	56
7629	Electrical Repair Shops	4,149	4,905
7629x		280	178
7699	Repair Services n.e.c. <sup>1</sup>	3,948	4,689
7699x		3,220	17,215
7813	Motion Picture Production except T.V.	2,500	2,610
7813x		72	10

Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)  
(continued)

SIC	Description	FY 1966	FY 1967
7814 7814x	Motion Picture Production for T.V.	2,500 72	2,611 10
8221 8221x	Colleges and Universities	1,407 306	1,995 239
8911 8911x	Architecture and Engineering Services	303,349 51,425	226,348 26,964
8921	Nonprofit Scientific Research Agencies	27,303	40,228
<hr/>			
NO SIC ASSIGNABLE			
	Grants, Subsidies and Contrib.	1,993	3,513
	Grants, Subsidies and Contrib. x	786	0
	Tort Claims	7	28
	Tort Claims x	1	0
	Awards	105	8
	Awards x	14	18
<hr/>			
UNBROKEN OBJECT CLASSES			
251x	Contracts for Research, Development, Test Evaluation purposes, excluding R & D.	153,492	82,907
258	Other Service Contracts: Subsistence; Board and Lodging; Hospital; Land Title Abstract Fees; Insurance Pre- miums; Surety Bonds.	82,000	67,155
258x		9,729	12,514
561	Building Materials: Lumber; Millwork; Veneer; Construction and Building Materials.	1,068	1,237
561x		127	101

Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)  
(continued)

UNBROKEN OBJECT CLASSES	FY 1966	FY 1967
563x    Electrical Materials:    Electric Wire and Power Distribution Equipment; Lighting Fixtures; Alarm and Signal Systems.	327	740
566    General Maintenance Materials &    and Mechanical Equipment: Mech. 611    Power Transmission Bearings; Construction; Materials Handling; Rope and Fittings; Refrigeration and Air Conditioning; Furnaces; Plumbing; Sewage; Prefab. Structures.	9,544	6,307
566x & 611x	690	291
567    General Operating Materials: Nuclear Ordnance; Fire Control Equipment; Woodworking and Metalworking Machinery; Hand Tools Brushes and Paints; Textiles. . .	7,052	8,052
567x	1,467	1,550
568    General Service Materials: Agricultural Machinery; Fire Fighting Machinery; Medical Supplies; Food Prep. and Serving Equipment; Recreational Equipment; Cleaning Supplies; Containers; Clothing; Toiletries; . . .	2,848	3,444
568x	578	648
573x    Missiles, Aircraft, and Vehicles: Guided Missiles; Aircraft, Launching and Handling Equipment; Space Vehicles; Pontoon; Ship Equipment; Cycles; Tractors; Tires and Tubes; Engines. . .	3,030	2,109
574    Office Supplies:    Furniture; Appliances; &    Office Machines; Office Supplies and 619    Devices; Books, Maps and other Publications.	12,107	12,922
574x & 619x	2,322	2,183

Final Demand Vectors  
Fiscal Years 1966 and 1967  
(\$000)  
(continued)

UNBROKEN

OBJECT

CLASSES

Description

FY 1966

FY 1967

617x	Electrical and Electronic equipment: Communication Equipment; Components, Wire and Power Distribution Equipment; Lighting Fixtures; Alarms etc....	14,147	1,931
623	Personnel Services Equipment: Food Preparation; Phonographs; Recreation Equipment; Clothing; Toiletries; Subsistence;	1,141	588
623x		63	60
625x	Misc. Equipment: Includes Nuclear Ordnance; Plywood; Paint; Textiles; Fuels and Lubes, Metal Bars and Ores, etc . . . .	855	72
ACCRUED TOTAL:		6,035,312 <sup>2</sup>	5,326,960 <sup>2</sup>

FOOTNOTES:

1. n.e.c. = not elsewhere classified
2. Figures may not sum to accrued totals due to rounding.



## APPENDIX

The industrial breakdown of NASA expenditures begins with highly aggregated accrued cost figures obtained from NASA's Financial Management Division. These figures are shown in Table I of the text of this report as the totals for Administrative Operations (A.O.), Research and Development (R & D), and Construction of Facilities (C of F). As noted in the text, the accrued cost figures are the closest available representation of resources absorbed directly from the economy by NASA's activities during the 1966 and 1967 fiscal years. Their only omission in representing resource use is the failure to include an "inventory change" created by items purchased but not allocated to specific programs on the one hand, and items not purchased during the current fiscal year but allocated to specific programs (and therefore to accrued cost) on the other. The change in this unassigned and unrepresented inventory is generally less than .1% of total expenditures.

### I. Fund Source Breakdown

As shown in Table I of the text, there is a breakdown of the three categories of expenditures into fund sources used in the process of obtaining congressional appropriations for the space program. This fund source breakdown was found to be useful for our project, particularly within the A.O. category. Its accrued cost representation required some data manipulation as indicated below. A direct fund source breakdown of accrued cost data was not available for the A.O. category. An accounting obligations printout furnished by the Resources Analysis Division was the basic data source used in the initial Administrative Operations fund source breakdown. The detail of this printout is given by the "object class" used to describe and categorize various types of expenditures in NASA's accounting system.

The obligations printout was also important for data adjustments to be described in a later section of this appendix.

Fund Source 1: Obligations are taken as a direct measure of accrued cost for wages and wage supplements. The difference between the accrued cost and obligations concepts is primarily in refunds due NASA on overpayment of wages and salaries--less than .5% of the total wage bill. Data on accruals were not available.

Fund Source 2: Obligations for fund source 2 are based on Travel Requests submitted for travel during a particular fiscal year, and therefore represent an estimate that is appropriate for the concept of resource use during that fiscal year. Accrued cost is based on the presentation of travel vouchers, and this often occurs with a considerable time lag. Actually overlaps between fiscal years tend to be offset from year to year, and there were only minor differences between the obligations and accrued cost figures. The obligations figure was used.

Fund Source 3 is an Administrative Operations residual obtained by subtracting the sum of fund sources 1 and 2 from the A.O. accrued cost total. Any discrepancies between obligations and accrued cost in the A.O. category must be almost exclusively in fund source 3, since it is only here that long term commitments can lead to a sizeable distinction between the concepts of accrued cost and obligations. The residual calculation was therefore judged superior to the use of obligations data as a representation of fund source 3 accruals. Obviously, the accuracy of the residual depends on the accuracy of the use of obligations to represent accruals for fund sources 1 and 2.

Fund Source 4: Accrued cost data on R & D , which is synonymous with fund source 4 in the accounting framework used by NASA , were directly available from NASA's Financial Management Division.

Fund Sources 5-8: Accrued cost data on the fund source breakdown for Construction of Facilities were directly available from NASA's Financial Management Division. This fund source breakdown was not useful in the assignment of SIC codes to accrued cost data on individual construction projects. The breakdown was therefore subsequently dropped.

## II. Fund Source Adjustment

The assignment of expenditures to fund sources by NASA is not always consistent with the nominal title of the fund source. For this reason -- and for the related purpose of adjusting the fund sources so that items included are consistent with the sample data used for estimating industrial breakdowns -- several transfers were made between the various fund sources. The nature of these transfers is illustrated by Schematic I.

The best source of data available to the authors for judging the necessity for, and making the fund source transfers was the obligations printout. As previously noted this printout provides a fairly detailed breakdown of fund source expenditures into "object classes" used for the assignment of obligations in NASA's accounting system. The result of the fund source transfers are shown below as appendix Table I. These figures represent the adjusted totals for accrued cost that will be used in establishing the industrial breakdown of NASA activity.

Schematic I  
Direction of Fund Source Transfers

Administrative Operations			Research and Development	Construction of Facilities
Fund Sources			Fund Source	Fund Sources
1 Wages and Supplements	2 Travel	3 Misc. A.O.		
X		→		
X			→	
	X	→		
		← X		
		X	→	
		X		→
	←		X	
		←	X	
			X	→

TABLE I

NASA Expenditures: Adjusted Accrued Cost  
by Fund Source Categories

Expenditure Category	FY 1966	FY 1967
A. Administrative Operations	<u>1,057,703</u>	989,534
1. Fund Source 1 Wages and Supplements	379,717	409,844
2. Fund Source 2 Travel	19,781	19,647
3. Fund Source 3 Miscellaneous A.O.	658,205	560,043
B. Research and Development (Fund Source 4)	<u>4,351,222</u>	<u>4,024,345</u>
C. Construction of Facilities (Fund Sources 5-8)	<u>623,561</u>	<u>310,255</u>
D. Government Provision of Building Space (GSA)	<u>2,826</u>	<u>2,826</u>
Total Adjusted Accrued Cost	<u>6,035,312</u>	<u>5,326,960</u>

The following description details the transfers and other adjustments by fund source:

Fund Source 1: In 1966 there were two small items not directly related to wages that were transferred to fund sources 3 and 4. These items were deobligations and are therefore shown as negative numbers. In 1967 there was a substantial item of real estate fees in connection with the movement of NASA personnel that was shifted to fund source 3. These transfers are shown in Table II - a.

TABLE II - a  
Fund Source I Adjustments  
(\$000)

	FY 1966	FY 1967
FS 1 - Text Table I	\$379,706	\$410,113
Transfers to (-)		
FS 3	-6	269
FS 4	-5	0
Adjusted FS 1 (Appendix Table 1)	\$379,717	\$409,844

Fund Source 2: Travel contains a few thousand dollars belonging to miscellaneous administrative operations and to R & D. More significant are the elements of travel found in fund sources 3 and 4 that must be transferred to fund source 2. These transfers are shown in Table II - b.

TABLE II - b  
Fund Source 2 Adjustments  
(\$000)

	FY 1966	FY 1967
FS 2 - Text Table I	\$17,702	\$17,920
Transfers from (+)		
FS 3	2,040	1,726
FS 4	39	6
Transfers to (-)		
FS 3	0	5
Adjusted FS 2 (Appendix Table I)	\$19,781	\$19,647

Fund Source 3: Adjustments to miscellaneous administrative operations consist of; a) transfers from fund source 4 of miscellaneous items that do not represent private research and development of the type covered by the EIS sample that is used for the industrial breakdown of fund source 4 accrued costs; b) transfers to fund source 4 of items of the type covered by the EIS sample that appeared in fund source 3; c) transfers to fund sources 5-8 of construction items appearing in fund source 3; and d) the previously noted transfers to and from fund sources 1 and 2. It should be noted that these transfers were made in terms of obligations, since the detailed obligations printout was used for identifying transfer items. However, items transferred from either fund source 3 or fund source 4 were first adjusted for the overall discrepancy between obligations and accrued cost within the fund source from which they were transferred. These adjustments should improve the accuracy of the overall transfers (in the sense that they should provide

a better reflection of accrued cost) but not necessarily the accuracy of each item. The latter would depend on the relative closeness of the individual obligations figure to accrued cost before and after adjustment. The adjustment factors are given below as ratios of accrued cost to obligations by year and by fund source.

	FY 1966	FY 1967
Fund Source 3	.9745	.9938
Fund Source 4	1.1307	1.0773

Transfers to and from fund source 3 are shown in Table II - c.

TABLE II - c  
Fund Source 3 Adjustments  
(\$000)

	FY 1966	FY 1967
FS 3 - Text Tabel I	\$208,678	\$217,671
Transfers from (+)		
FS 1	-6	269
FS 2	0	5
FS 4	542,671	438,788
Transfers to (-)		
FS 2	2,040	1,726
FS 4	60,887	58,545
FS 5-8	<u>30,211</u>	<u>36,419</u>
Adjusted FS 3 (Appendix Table I)	\$658,205	\$560,043



Fund Source 4: Although labeled as Research and Development, fund source 4 often serves as a catch all for items that can be identified with a specific space program. Transfers to fund sources 2 and 3 from fund source 4, and from fund sources 1 and 3 to fund source 4 have already been discussed. There are also construction items that must be transferred to fund sources 5-8. Again the reader should note that the transfers initially located in fund sources 3 and 4 are in terms of obligations adjusted by a factor representing the overall obligations-accruals discrepancy for the fund source from which the transfer is made. Error in the individual items that will ultimately be assigned an industrial code is therefore inevitable. Fund source 4 transfers are shown in Table II -d.

TABLE II - d  
Fund Source 4 Adjustments  
(\$000)

	FY 1966	FY 1967
FS 4 - Text Table I	\$4,851,293	\$4,428,688
Transfers from (+)		
FS 1	-5	0
FS 3	60,887	58,545
Transfers to (-)		
FS 2	39	6
FS 3	542,671	438,778
FS 5-8	<u>18,243</u>	<u>24,094</u>
Adjusted FS 4 (Appendix Table I)	\$4,351,222	\$4,024,345

Fund Sources 5-8: A detailed accrued cost printout for fund sources 5-8 indicated no items that needed to be transferred to other fund sources. The transfers are therefore those previously indicated as going to fund sources 5 - 8 from fund sources 3 and 4. These transfers are shown in Table II - e.

TABLE II - e  
Fund Source 5-8 Adjustments  
(\$000)

	FY 1966	FY 1967
FS 5-8 Text Table I	\$575,107	\$249,742
Transfers from (+)		
FS 3	30,211	36,419
FS 4	<u>18,243</u>	<u>24,094</u>
Adjusted FS 5-8 (Appendix Table I)	\$623,561	\$310,255

Building Space: Rent is not charged for building space allocated to government agencies through the Government Services Administration. During fiscal years 1966 and 1967 NASA used approximately 595,000 square feet of such space. With rental rates for the South West Washington area averaging \$4.75 per square foot per year, an estimate of \$2,826,000 was entered for building space used during both fiscal years. This figure is the final entry in appendix table I. It accounts for the discrepancy in the totals for this table as compared with Table I of the text.

### III. Assignment of SIC Codes

The remaining task is to disaggregate the data in appendix Table I according to the industrial classification (SIC code) assigned to individual expenditures. The transfers and other adjustments of the fund source categories were designed to facilitate this process by providing adjusted categories that are consistent with the data sources used for industrial classification.

Fund Source 1 - wages and wage supplements - represents NASA's value added. As a payment to a primary factor of production, with no further involvement in the contracting and subcontracting process, it does not have a SIC assignment.

The detail of fund source 2 expenditures was provided by the obligations printout, noted in the text and described earlier in this appendix. Certain types of expenditures were classified by mode of travel or other type classification (taxi fares, plane rental, car rental, and parking). SIC codes were assigned directly to these items according to description. Primary transportation (almost exclusively air travel) and per diem were usually classified according to the purpose of a trip --- not a helpful classification for our purpose. In order to reclassify these items, each of NASA's major installations chose a "typical" travel month and provided a breakdown of airline and per diem expenditures for that month. A weighted average of these sample proportions provided a means for reclassifying those items described according to trip purpose as air travel, hotel expenditures, and meal expenditures. SIC codes were then assigned to these categories. Per diem was assumed to be spent in a ratio of 2/3 for accommodations and 1/3 for meals.

The individual fund source 3 items described in the obligations print-out were adjusted for the overall discrepancy between obligations and accruals for that fund source. The adjustment factors are those given on page 8 in the discussion of transfers from fund source 3. Direct assignments of SIC codes were made to the adjusted items. Aid from knowledgeable NASA personnel in the Resources Analysis Division was helpful in many of these SIC assignments.

The Contractors' Economic Information System described in the text provided the sample for industrial classification of research and development expenditures as represented by our adjusted fund source 4. The items actually used from this source were 1) SIC code, 2) total accrued cost on NASA contracts, 3) percentage of labor expended on NASA contracts that was associated with prime contracts. In order to get a figure for NASA prime contract accrued cost, the NASA total accrued cost was multiplied by the percentage of "NASA labor" used for prime contracts. This involved an assumption that the labor intensity of prime contract work was the same as for subcontract work. There is the possibility of bias resulting from the lack of uniform correctness of this assumption throughout the sample.

The EIS system covers 75-80% of all NASA contracts with virtually complete coverage of large contracts. However, inadequate data for many of the smaller contracts led to their elimination from the sample. This also led to the restriction of fund source 4 to those types of expenditures that were actually represented in the sample. As shown by the expansion factors used to inflate sample values to the value of adjusted fund source 4 accrued cost, the restriction resulted in an 80-90% coverage by the sample.

Fund Source 4-EIS Expansion Factors

<u>1966</u>	<u>1967</u>
1.0984	1.1753

It should be noted that the concentration on large contracts in the sample, created by a deliberate cut off point in the sampling procedure and emphasized by the problem of missing data associated with many of the smaller contractors included in the sample is a possible source of bias. The absolute error involved cannot be large because of the high percentage of coverage by the sample.

Construction of facilities expenditures were classified by assigning SIC codes to a 10% random sample of construction-contract accrued cost as contained in NASA SCAG 12 printout. Knowledgeable personnel from NASA's Office of Facilities were very helpful in assigning SIC codes to these contracts on the basis of contract descriptions contained in the SCAG 12 printout. Although there was no apparent bias in sampling procedure, the expansion factors used to adjust the contract random sample of accrued C. of F. costs indicates that the actual accrued cost covered by the sample was greater than 10% of construction expenditures -- particularly in 1966.

Fund Sources 5-8 SCAG 12 Expansion Factors

<u>1966</u>	<u>1967</u>
5.7517	8.4200

The assignment of SIC codes, the expansion of sample data to equal fund source totals (when appropriate), and the recombination of data from

fund source classification to SIC classification provides the final demand vectors of NASA activity as given by Table II of the text. The following comments are related to interpretation of the final demand vectors.

There are several types of special classifications that should be noted.

1. An SIC code followed by an x indicates that the activity, although identifiable as the type carried on by the industry indicated, was actually performed by a government agency.
2. For 7399 (business services n.e.c.) there were two large groups of activity that could be fairly closely identified. These are: 7399 a, Computer programming and operating services, and 7399 xb, fees paid to government agencies (usually the Army Corps of Engineers) for administration of construction contracts.
3. There are combinations of four-digit SIC codes in the important area of aircraft and aircraft engines. This classification is covered by the 3720's in the SIC coding scheme. For NASA these numbers cover the contracts for rocket engines, space capsules, and related hardware. The combinations within this area resulted from two considerations.
  - a. There was frequent inconsistency in the assignment of SIC codes to contracts by companies engaged in essentially similar activity.

- b. A contract would frequently cover hardware from more than one "industry" as designated by the SIC codes.

The SIC codes involved are:

3721 Aircraft

3722 Aircraft Engines and Parts

3729 Aircraft Parts and Auxiliary Equipment n.e.c.

There were two situations where no SIC code was assignable.

1. No SIC classification is available for a very limited number of pecuniary activities such as grants and tort claims.
2. Several items listed in the obligations printout were too diverse to be assigned a single SIC number, and none of the data available at NASA headquarters provided for a reasonable breakdown of the figures. These items are listed with their "object class" designations and descriptions taken from NASA's accounting format. The unassigned categories account for 4-5% of NASA's expenditures during the two fiscal years. The largest items involve contracts with other government agencies - including basic research, and military services associated with space shots and recovery operations.

Throughout this study we have faced the problem of correct SIC code assignment and the appropriateness of the SIC classification scheme for the type of activity in which NASA is engaged. In some cases the Budget Bureau description of an SIC code bore only a remote resemblance to the good or service provided by contractors associated with the code. In other cases

The activity was a very small and somewhat unusual segment of the industry indicated by the SIC code. The problem posed by these discrepancies is primarily in the area of using our final demand vectors in connection with national input-output tables for an impact analysis. If the resources used for NASA are not the same as resources used for the "typical" or "average" product of an industry, then input columns from a national input-output table would be highly misleading and the resulting impact analysis a poor representation of NASA's actual direct and indirect resource use.

What our final demand vectors attempt is a classification of NASA procurement into homogeneous industrial categories. In some cases the "industries" created by this classification are almost wholly peculiar to NASA. As a consequence, an impact analysis of NASA expenditures will need to include the construction of special input vectors to represent industries; 1) that are important in NASA's procurement, and 2) where NASA's hardware requires a resource usage of markedly different kinds or in markedly different proportions than is required for these industries' more typical products.